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NAVAL DENTAL RESEARCH INST GREAT LAKES ILL
SUMMARIES OF RESEARCH, 1 JANUARY - 30 SEPTEMBER 1976.(U)
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SUMMARIES OF RESEARCH
1 January-30 September 1976.

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Naval Medical Research and Development Command
Bethesda, Maryland

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SUMMARIES OF RESEARCH

01 JAN 1976 - 30 SEP 1976

These summaries cover research carried out from 01 Jan 76 through 30 Sep 76.

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Submitted by:

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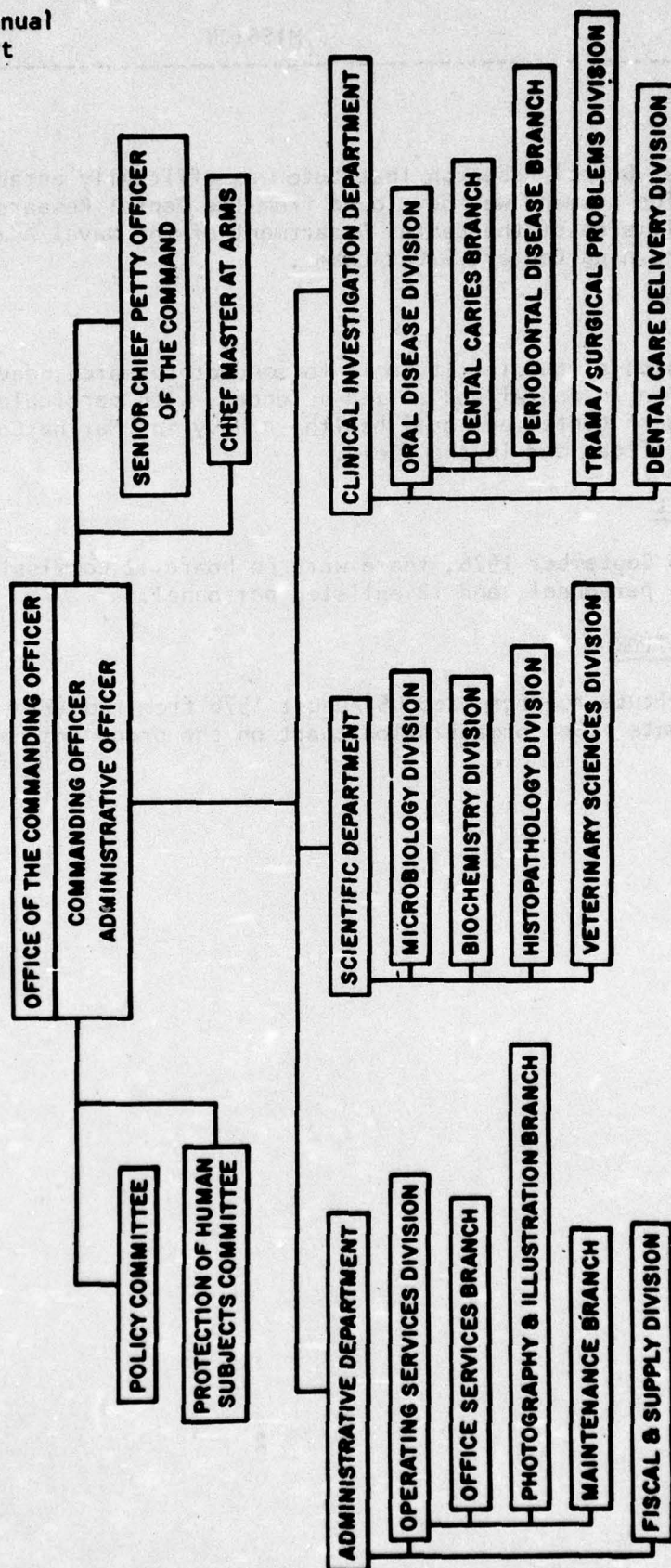
TABLE OF CONTENTS

ORGANIZATIONAL CHART	1
MISSION	2
FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES, RESULTS REPORTED AND/OR DISCUSSIONS LED	3
PARTICIPATION IN OTHER PROGRAMS	6
CURRENT WORK UNITS	9
RESEARCH PROGRESS REPORTS - 01 JAN 76 thru 30 SEP 76	10
OTHER PUBLICATIONS	11
DISTINGUISHED VISITORS	13
STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS	14
HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES AND REENLISTMENTS	20

1. Organizational Manual
2. Organization Chart

NOTE 1. Comptroller and Military Personnel Records support performed by Naval Regional Medical Center, Great Lakes. Civilian Personnel Record Support performed by CCPO, Great Lakes.

NAVAL DENTAL RESEARCH INSTITUTE



DATE: 5 August 1976 APPROVED: *Milton R. Wirthlin Jr.*
MILTON R. WIRTHLIN JR., CAPTAIN, DC/USN

TITLE OF PARENT ORGANIZATION : NMRDC
TITLE OF FIELD ACTIVITY : NAVAL DENTAL RESEARCH INSTITUTE

MISSION

COMMAND

The Naval Dental Research Institute was officially established 01 January 1967. The command was developed from the Dental Research Facility, which was a Division of the Dental Department of the Naval Administrative Command, Naval Training Center, Great Lakes.

MISSION

The mission of the Institute is to conduct research, development, test and evaluation in dental and allied sciences, with particular emphasis on problems of dental and oral health in Navy and Marine Corps populations ashore, afloat and in the field.

PERSONNEL

As of 30 September 1976, there were on board 12 commissioned officers, 13 civilian personnel, and 12 enlisted personnel.

ORGANIZATION

The Institute re-organized 05 August 1976 from two (2) to three (3) Departments. See organization chart on the preceding page.

FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES

RESULTS REPORTED AND/OR DISCUSSIONS LED

JANUARY

Scientific and Clinical Staff presented summaries of ongoing research to Dr. Dorland Davis and Mr. William Soyars of the House Appropriations Committee.

FEBRUARY

WALTER, R. G. presented a discussion on "Role of Immune Response in Periodontal Disease" to a group of dental officers assigned to the Naval Regional Dental Center, Great Lakes, Illinois.

MARCH

International Association for Dental Research Meeting, held at Miami Beach, Florida, was attended by:

COTTON, W. R. Chairman, Endodontic Session.

Presided at Pulp Biology Group/Chapter meeting.

Presented "Response to Citric Acid Cavity Cleanser" as part of IADR symposium on "Pulp and Dentin Response to Material Systems Using Etching Agents."

Presented "Parathyroid Hormone as a Possible Factor in Osteopetrosis."

KEENE, H. J. Co-authored oral presentation of "Gingivitis, Bacterial Plaque and S. mutans in Naval Recruits from Saudi Arabia."

LAMBERTS, B. L. presented "Composition and Structure of Streptococcal Glucans as Revealed by ¹³C Nuclear Magnetic Resonance," which he co-authored with Dr. I.C.P. Smith, National Research Council of Canada.

OSBORNE, R. M. presented "Bicarbonate-Induced Changes in Sucrose-Metabolizing Enzymes and Cellular Morphology of S. mutans."

SHKLAIR, I. L. co-chairman of Microbiology Session.

Presented "Evaluation of a Selective Medium Color Test for Strep. mutans."

FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES
RESULTS REPORTED AND/OR DISCUSSIONS LED (Continued)

MARCH (Continued)

WALTER, R. G. presented "Site Distribution of Streptococcus mutans in Caries-Free and Caries-Active Recruits."

WIRTHLIN, M. R. presented "Gingivitis, Bacterial Plaque, and Streptococcus mutans in Naval Recruits from Saudi Arabia."

YEAGER, J. E. presented "Tooth Transplantation in RhL-A Typed Monkeys."

WIRTHLIN, M. R. presented a seminar on "Examination and Diagnosis" and a seminar on "Clinical Judgment" at the Naval Regional Dental Center, Great Lakes.

APRIL

12th Annual Dental Students Conference in Research, sponsored by the Chicago Chapter of the American Dental Association was attended by:

ANDERSON, D. M. presented "Treatment of Deep Carious Lesions."

GAINES, J. F. presented "Animal Models in Dental Research."

KEENE, H. J. acted as Moderator.

LEONARD, E. P. presented "The Histopathology of Periodontal Disease."

SHKLAIR, I. L. presented "Strep. mutans and Dental Caries."

WIRTHLIN, M. R. presented "Research in Preventive Dentistry and Periodontics."

COTTON, W. R. presented "Demonstration of Human Salivary Antibodies by Latex Spheres as Immunologic Markers," at SEM Symposium sponsored by Illinois Institute of Technology Research Institute, held in Toronto, Canada.

GAINES, J. F. presented "Rabies" to Naval Regional Medical Center, Great Lakes, professional and paraprofessional staff.

MAY

KEENE, H. J. presented "Research Programs of the Naval Dental Research Institute" for briefing for COMNINE.

**FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES
RESULTS REPORTED AND/OR DISCUSSIONS LED (Continued)**

MAY (Cont.)

WIRTHLIN, M. R. presented "Research and Clinical Applications" to general practice residents at the Naval Regional Medical Center, Great Lakes.

JUNE

SHKLAIR, I. L. presented "The Biochemical Characterization and Distribution of Streptococcus mutans in Three Diverse Populations," at a workshop on Microbial Aspects of Dental Caries held by H.E.W., National Institute for Dental Research, S. Simons Island, Georgia.

PARTICIPATION IN OTHER PROGRAMS

JANUARY

Meeting of the Chicago Section of the American Association for Dental Research was attended by:

ANDERSON, D. M.
LEONARD, E. P.
SHKLAIR, I. L.
WIRTHLIN, M. R.

Lecture on Occlusion by Dr. D. Pippia, given at the Great Lakes Dental Society meeting, was attended by:

ANDERSON, D. M.
WIRTHLIN, M. R.
YEAGER, J. E.

Seminar on Periodontal Pathogenesis, given by Dr. E. Barrington, at the Naval Regional Medical Center, was attended by:

LEONARD, E. P.
WIRTHLIN, M. R.

COTTON, W. R. visited the Naval Medical Research Institute, Bethesda, Maryland.

WIRTHLIN, M. R. attended Symposium on Treatment of Osseous Defects at University of Southern California.

FEBRUARY

Naval Reserve Luncheon held in conjunction with the Chicago Midwinter Dental meeting was attended by:

COTTON, W. R.
LEONARD, E. P.
WALTER, R. G.
WIRTHLIN, M. R.

ANDERSON, D. M. attended American Academy of Restorative Dentistry meeting in Chicago.

WIRTHLIN, M. R. attended Midwest Society of Periodontology annual meeting.

PARTICIPATION IN OTHER PROGRAMS (Continued)

MARCH

54th General Session of International Association for Dental Research and Annual Session of American Association for Dental Research, Miami Beach, Florida, was attended by:

ANDERSON, D. M.
COTTON, W. R.
LAMBERTS, B. L.
LEONARD, E. P.
OSBORNE, R. M.
SHKLAIR, I. L.
WALTER, R. G.
WIRTHLIN, M. R.
YEAGER, J. E.

DOWNING, C. A. attended G. E. Panelipse School at Milwaukee, Wisconsin.

APRIL

COTTON, W. R. attended SEM Symposium, IIT Research Institute, in Toronto, Canada.

LAMBERTS, B. L. consulted with Dr. Ian Smith of National Research Council of Canada and Dr. Richard Egan of Abbott Laboratories, at Abbott Laboratories, North Chicago, Illinois, on a collaborative study on nuclear magnetic resonance studies of streptococcal polysaccharides.

SHKLAIR, I. L. attended Chicago Section of American Association for Dental Research.

MAY

Meeting of the Chicago Section of American Association for Dental Research, held at Great Lakes Officers' Club, with Guest Speaker, Dr. Eric Carlson of Adler Planetarium, was attended by:

ANDERSON, D. M.
COTTON, W. R.
KEENE, H. J.
LAMBERTS, B. L.
LEONARD, E. P.
SHKLAIR, I. L.
SIMONSON, L. G.
WIRTHLIN, M. R.
YEAGER, J. E.

PARTICIPATION IN OTHER PROGRAMS (Continued)

MAY (Cont.)

GAINES, J. F. attended course in Operational Laboratory Animal Medical Problems, Brooks Air Force Base, Texas.

KEENE, H. J. visited Naval Medical Research and Development Command, Bethesda, and BUMED to discuss research programs.

JUNE

SIMONSON, L. G. attended American Dental Association Electron Optics Lab in Chicago.

YEAGER, J. E. attended presentation of "Diagnosis and Treatment Planning for Orthognathic Surgery," at Naval Hospital, Great Lakes.

JULY

DOWNING, C. A. attended a 5-day workshop at Bethesda, Maryland working to write an instruction to promulgate guidance for administration and operation of an effective Navy-wide dental equipment preventive maintenance program.

LAMBERTS, B. L. attended a meeting of officers of Chicago Section, American Association for Dental Research to plan programs for the coming year.

WIRTHLIN, M. R. attended dedication of new Dental Building Complex, University of Illinois at the Medical Center, Chicago.

SEPTEMBER

Meeting of the Great Lakes Dental Society was attended by:

ANDERSON, D. M.

CLARK, G. E.

GALICH, J. W.

YEAGER, J. E.

ANDERSON, D. M. traveled to the University of Connecticut in Farmington for consultation/collaboration with Dr. Kaare Langeland.

GAINES, J. F. attended the Chicago-Milwaukee interbranch meeting of American Association of Laboratory Animal Science.

YEAGER, J. E. attended the annual meeting of the American Society of Oral Surgeons in New York.

CURRENT WORK UNITS

- MR041.20.02.0408 - Microorganisms in Induced Periodontal Disease
- MR041.20.02.0421 - Immunological Analysis of Tooth Transplants in Mice, Monkeys, and Man
- MR041.20.02.6041 - Pulpal Response to Citric Acid Cavity Cleanser as Applied During Dental Caries Treatment of Naval Personnel
- MR041.20.02.6048 - Biochemistry of Infection-Free and Pathological Oral Environments in Naval Recruits
- MR041.20.02.6049 - Studies of Microorganisms Involved in Oral Diseases of Naval Personnel
- MF12.524.012.0001 - Chemical Factors and Nutrition in Resistance to Infections of Oral Structures - Terminated
- MF12.524.012.0006 - Oral Health of Naval Personnel
- MF51.524.012.0002 - Bacteriology of the Oral Environment in Caries-Free Naval Recruits
- MF51.524.012.0012 - Polysaccharides from Oral Bacteria Associated with Dental Decay and Periodontal Disease
- MPN03.04.3008 - Evaluation of Expedient Procedures for Treating Dental Pulp Disease in Naval Personnel
- MPN03.04.3010 - Wound Healing of the Supporting Tissues of the Teeth of Naval Personnel
- MPN03.04.3011 - An Evaluation of Dental Implant Materials, Designs, and Surgical Techniques as Applied to Navy and Marine Corps Personnel

INDEPENDENT RESEARCH PROJECTS

- MR000.01.0012 - Evaluation of Certain Physical and/or Enzymic Methods for Determining Structural Characteristics of Streptococcal Polysaccharides
- MR000.01.0013 - Epidemiology and Treatment of Necrotizing Gingivitis in Naval Personnel
- MR000.01.0014 - Evaluation of Navy Plaque Control Program

RESEARCH PROGRESS REPORTS - 1976

- NDRI PR 76-01 Characterization of an Extracellular Dextranase
from *Fusarium moniliforme*
L. G. SIMONSON, A. E. LIBERTA and A. RICHARDSON
(Applied Microbiol. 30:855-861, 1975)
- NDRI PR 76-02 Summaries of Research 1975
Staff
- NDRI PR 76-03 Acrylamide Gel Electrophoretic Studies of Extra-
cellular Sucrose-Metabolizing Enzymes of
Streptococcus mutans
R. M. OSBORNE, B. L. LAMBERTS, T. S. MEYER and
A. H. ROUSH
(J. Dent. Res. 55:77-84, 1976)
- NDRI PR 76-04 Invertase in Cell-Free Culture Fluids of *Streptococcus*
mutans Strain SL-1
R. M. OSBORNE, B. L. LAMBERTS and A. H. ROUSH
(Experientia 31:1399-1401, 1975)
- NDRI PR 76-05 Demonstration of Human Salivary Antibodies by
Latex Spheres as Immunologic Markers
G. R. RIVIERE, W. R. COTTON and J. L. DERKOWSKI
(Scanning Electron Microscopy/1976 (Part V), pp. 67-
74, 1976)
- NDRI PR 76-06 Let Your Antibody Work - Immunize Early
I. L. SHKLAIR and H. J. KEENE
(J. Dent. Res., Special Issue C, 55:C224-C225,
1976)
- NDRI PR 76-07 Partial Elimination of *Streptococcus mutans* from
Selected Tooth Surfaces After Restoration of
Carious Lesions and SnF₂ Prophylaxis
H. J. KEENE, I. L. SHKLAIR and K. C. HOERMAN
(JADA 93:328-333, 1976)

OTHER PUBLICATIONS

- COTTON, W. R., WILLIAMS, G. A., HARGIS, G. K. and J. F. GAINES, "Parathyroid Hormone as a Possible Factor in Osteopetrosis," (Abstract #960) J. Dent. Res. 55(Special Issue B):B302, 1976.
- COTTON, W. R., WILLIAMS, G. A., HARGIS, G. K. and J. F. GAINES, "Parathyroid Hormone as a Possible Causal Factor in Osteoporesis in the tl Rat," Endocrinology 99:3, p. 872-874, 1976.
- KEENE, H. J., SHKLAIR, I. L. and K. C. HOERMAN, "Partial Elimination of Strep. mutans from Selected Tooth Surfaces After Restoration of Carious Lesions and SnF₂ Prophylaxis," JADA 93:328-33, 1976.
- LAMBERTS, B. L. and I. C. P. SMITH, "Composition and Structure of Streptococcal Glucans as Revealed by ¹³C Nuclear Magnetic Resonance," (Abstract #850) J. Dent. Res. 55(Special Issue B):B274, 1976.
- LEONARD, E. P., LA BARBERA, T. A. and I. L. SHKLAIR, "Paradontopathic Potential of S. mutans and A. viscosus in the Rat," (Abstract #608) J. Dent. Res. 55(Special Issue B):B214, 1976.
- OSBORNE, R. M., LAMBERTS, B. L., BUCK, K. J. and I. L. SHKLAIR, "Bicarbonate-Induced Changes in Sucrose-Metabolizing Enzymes and Cellular Morphology of S. mutans," (Abstract #1011) J. Dent. Res. 55(Special Issue B):B314, 1976.
- RIVIERE, G. R., COTTON, W. R. and J. L. DERKOWSKI, "Demonstration of Human Salivary Antibodies by Latex Spheres as Immunologic Markers," Scanning Electron Microscopy/1976/II, IIT Research Institute, Chicago, pp. 67-74, 1976.
- SHKLAIR, I. L. and R. G. WALTER, "Evaluation of a Selective Medium Color Test for Streptococcus mutans," (Abstract #241) J. Dent. Res. 55(Special Issue B):B122, 1976.
- SIMONSON, L. G., LIBERTA, A. E. and A. RICHARDSON, "Characterization of an Extracellular Dextranase from Fusarium moniliforme," Applied Microbiology 30:855-861, 1976.
- WALTER, R. G. and A. S. WINDELER, "Solubilization of Interfering Tin Precipitate in Bacterial Growth Media," J. Dent. Res. 55:2, p. 311, Mar-Apr 1976.
- WALTER, R. G. and I. L. SHKLAIR, "Site Distribution of Streptococcus mutans in Caries-Free and Caries-Active Recruits, (Abstract #468) J. Dent. Res. 55(Special Issue B):B178, 1976.

OTHER PUBLICATIONS (Continued)

WIRTHLIN, M. R., KEENE, H. J. and I. L. SHKLAIR, "Gingivitis, Bacterial Plaque, and Streptococcus mutans in Naval Recruits from Saudi Arabia," (Abstract #797) J. Dent. Res. 55(Special Issue B):B261, 1976.

YEAGER, J. E., RIVIERE, G. R. and G. W. DILS, "Tooth Transplantation in RhL-A Typed Monkeys," (Abstract #927) J. Dent. Res. 55(Special Issue B):B293, 1976.

DISTINGUISHED VISITORS

JANUARY

Dr. Dorland DAVIS, House Appropriations Committee, Washington, D.C.
Dr. W. B. SOYARS, House Appropriations Committee, Washington, D.C.
Dr. C. WEITHOUS, LCDR, USNR, Mukwonago, Wisconsin
Ms. Annette LEONARDI, RN, Lake County Public Health Dept., Waukegan, IL
Dr. Kirk HOERMAN, Lake Forest, Illinois

FEBRUARY

Dr. E. Eugene FISHER, Wm. Wrigley, Jr., Co., Chicago, Illinois
CDR W. SWINDALL, MSC, USN, CO, Hospital Corps School, Great Lakes, IL
Dr. Kirk HOERMAN, Lake Forest, Illinois

MARCH

Dr. A. N. BAHN, Southern Illinois University, Edwardsville, Illinois

APRIL

Dr. Abdul ADATIA, University of Bristol Dental School, Bristol, England
RADM W. C. HAGERMAN, DC, USN, Inspector General, BUMED, Washington, D.C.
Dental Hygiene students from Harper College

MAY

Dr. Barbara PERI, LaRabida Children's Hospital, Chicago, Illinois

JUNE

CAPT C. E. BRODINE, MC, USN, CO, Naval Medical Research & Development
Command, Bethesda, Maryland
Dr. T. SPERRY, Aurora, Illinois
Dr. T. DANIELS, Rockford, Illinois
CDR J. CECIL, DC, USN, University of Michigan
Dr. WM. BRINER, Proctor & Gamble Company
Dr. D. F. MELISCH, University of Michigan
Dr. W. L. WROBEL, University of Connecticut
CAPT Jeanne GRUSHINSKI, NC, USNR, NYU College of Dentistry

JULY

RADM A. M. SACKETT, USN, Commandant, Ninth Naval District

AUGUST

Dr. F. S. SAYEGH, Chairman, Dept. of Histology, School of Dentistry,
University of Missouri
CAPT Wm. Hall, U.S. Public Health Service
CDR R. WALLER, U.S. Public Health Service

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS

CLINICAL INVESTIGATION DEPARTMENT

(Oral Diseases Division)

To establish a technique for standard wounds and quantitative analysis of repair, precise wounds of incision and partial excision were made in gingival margins of six miniature swine. Schedule of wounds provided unwounded control, and 0, 2, 7, 14 days post-operative healing of premolars and anterior teeth. At each time, the wounds were tested for rupture strength and samples removed for collagen analysis. Other specimens at the same time were prepared for histometrics and histology. Evaluation of results continues.

Referred clinical cases of necrotizing gingivitis are being accepted for examination and interview, to derive epidemiological data for a stochastic evaluation of etiologic pattern. Additionally, microbiological samples are being processed in the laboratory to isolate and identify spirochetes.

The study to evaluate conservative pulp therapy for deeply carious teeth with diseased, but viable, pulps is divided into three phases. In the first, or diagnostic phase, specimens continue to be collected in an attempt to correlate the clinical data from signs, symptoms, tests and history with the health and repair potential of the pulp as determined histologically.

In phase two, fifteen patients per week are screened for teeth with deep dentin caries which approximate the dental pulp. A tentative clinical diagnosis of pulp condition is made for each tooth, utilizing data from the diagnostic phase. Without influencing decisions, the examiners monitor the treatment given each tooth by recording the methods, materials and time expended at recruit and service school dental clinics. The collected data is coded for computer processing and analysis after two-year recall examinations.

During phase three, to begin in FY77, deeply carious teeth will be selected for conservative pulp treatment according to definite guidelines established earlier in the study.

Preliminary trials have been conducted in which pooled, filtered samples of human carious dentin were tested for toxicity in the skin of rabbits. After grinding and ultrasonic disruption, the samples were centrifuged, passed through an 0.22 μ filter, and then dialyzed. A lyophilized yield of 33 mg. was obtained from the caries of 39 teeth. After rehydration, the yield was fractionated by means of molecular weight filtration. Filtrates from washed, disrupted bacterial cells in caries were also prepared. To act as a control, sound dentin was processed in the same manner.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Cont.)

Various concentrations of the filtrates in phosphate-buffered saline were injected intradermally into the dorsa of rabbits. Intravenous injections of 1% Evans Blue facilitated observation of the reactions, which were judged to be useful as a fast, inexpensive method to test for toxicity. As work continues to isolate and identify those components of carious dentin which are toxic to the dental pulp, fractions will be tested intradermally, in tissue cultures, and in the teeth of primates.

(Trauma and Surgical Problems Division)

Four alloplastic materials - surgical grade Ticonium, vitreous carbon, aluminum oxide and acrylic - were used in the fabrication of dental endosseous implants of uniform design and are presently being tested as functional tooth root replacement systems in adult rhesus monkeys. Preliminary results based on a six month postoperative period, indicate that vitreous carbon and surgical grade Ticonium are superior to acrylic and aluminum oxide when used as endosseous implant materials. Upon completion of this phase of the study, specific designs for implants will be tested. Implants tested during Phase II will be fabricated from materials found to be most suitable for endosseous dental implants during Phase I.

The hypothesis that genetic typing followed by histocompatibility matching will enhance tooth allograft survival is being tested in thirty Rhesus monkeys. The monkeys were paired on the basis of their RhL-A antigens. Sixty teeth were transplanted - thirty allografts and thirty autografts. One year postoperative results revealed that the six best matched animals, in regard to their identifiable RhL-A antigens, had all retained their allografts. On the other hand, 20% of the total number of allogeneic tooth transplants had been exfoliated at that point. From the standpoint of retention, the matched allografts appeared superior to the mismatched allografts. It is further noted that 6.66% of the autografts had sloughed at one year. When the matched allogeneic transplants were compared with the autologous transplants on the basis of root development and eruption, the latter group was unquestionably superior. An 18 to 24 month post-operative follow-up is planned. During the final six months of the study, MLR testing and skin graft procedures will be used as a means of further evaluating and monitoring individual immunologic responses.

(Dental Care Delivery Division)

Evaluation of Navy Plaque Control Program is providing a current survey of health status of naval recruits at Great Lakes. This population of young men, 17 to 27 years old, has average age 19.2 years. The majority

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Cont.)

are high school graduates from towns of under 50,000 people. Their DMFT is 11.4 (DT = 5.7, MT = 0.7, FT = 7.2). The most notable change from the survey in 1966 is reduced missing teeth (MT = 1.7). Current DMFS is 23.8 (DS = 8.0, MS = 3.6, FS = 13.2). Analysis of sound, surfaces-at-risk is being done to determine caries attack rate at entry into service. Periodontal diseases were found in every subject, predominantly in localized to generalized marginal gingivitis. Navy Periodontal Screening Examination indices are NPDI = 6/18 and NPI = 17/84. At least one pocket score of 5 was found in 76% of the subjects, and only a rare subject is found without calculus.

Projected initial treatment requirements indicate 29,240 dental procedures would be required per 1,000 recruits. The number of DT = 0 and DMFT = 0 subjects was very low (2 to 3%) and would have little impact on clinical operations. The greatest burden was found in 1/3 of the sample who had at least one tooth with caries more than 3/4 through the dentin. There are too few completed subjects to assess the affect of plaque control on gingivitis and dental caries at this time, and the work continues.

SCIENTIFIC DEPARTMENT

(Biochemistry Division)

Since classical chemical methods of determining structures of polysaccharides are time-consuming and laborious, we have explored nuclear magnetic resonance as a means to elucidate the structures of extracellular glucans of Streptococcus mutans. This study was conducted collaboratively with Dr. Ian Smith of the National Research Council of Canada and Dr. Richard Egan of Abbott Laboratories. Structural data were obtained on four extracellular glucans produced by two Strep. mutans strains, both through chemical (permethylation) analyses and by carbon-13 nuclear magnetic resonance. Only α -(1 \rightarrow 3) and α -(1 \rightarrow 6) linkages were found and the less soluble the glucan, the greater was the proportion of α -(1 \rightarrow 3) linkages. Both analytical methods indicated that the α -(1 \rightarrow 3) linkages were present in linear, as well as in branch, configurations, with the linear type predominating about 3 to 4 fold. These findings suggested that the degree of water-insolubility of the glucans depended on the extent to which the glucosyl units occurred in linear α -(1 \rightarrow 3)-linked sequences.

A second approach we followed in investigating the structures of these glucans was the use of degradative enzymes. Several water-insoluble glucans, particularly the glucan from Strep. mutans strain K-1R, were incubated for 5-day periods with five different dextranases. Two end products obtained with every dextranase were a water-soluble nondialyzable fraction and a very water-insoluble residue. The two fractions showed different infrared characteristics with respect to each other and compared to the starting material. Proton magnetic resonance analyses showed that the water-soluble fraction contained both α -(1 \rightarrow 3) and α -(1 \rightarrow 6) linkages, whereas the water-

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Cont.)

insoluble residue contained only α -(1 \rightarrow 3) linkages and showed different spectral characteristics than were found with the soluble fraction. Optical rotations indicated that the water-insoluble residue was particularly alkali-labile, a quality that would be expected from glucosyl units in linear α -(1 \rightarrow 3)-linked sequence. It was presumed from these observations that the water-soluble nondialyzable material probably represented highly-branched molecules which were not degraded further because of steric hindrance to action by the enzymes. On the other hand, the water-insoluble residue represented molecules containing a relatively high content of linear α -(1 \rightarrow 3)-linked glucosyl residues.

A practical use that became apparent for the water-insoluble residue was to use it as the sole carbon source in culture media used for screening organisms for their ability to elaborate α -(1 \rightarrow 3)-glucanohydrolases. In this manner an actinomycete was discovered in a sample of organic sludge and was subsequently isolated. This organism has been found capable of completely solubilizing the water-insoluble glucans synthesized by Strep. mutans strains K-1R and OMZ 176, presumably by means of an α -(1 \rightarrow 3)-glucanohydrolase. Efforts to isolate this enzyme are in progress.

A study was also initiated to modify dextranases or α -(1 \rightarrow 3)-glucanohydrolases so that they would be absorbed more strongly than normally to tooth enamel while still retaining their enzyme activities. The means and specific conditions for modifying dextranase were explored. The alteration of glucanohydrolases to increase their binding capacities to tooth enamel could improve their effectiveness as possible antiplaque therapeutic agents.

The enzymes elaborated by Streptococcus mutans to synthesize sticky polysaccharides can be isolated from cell-free cultures of the organisms grown in a glucose-containing medium. The identification of conditions to achieve optimal yields is a desirable prerequisite for subsequent investigations of the roles of these enzymes in bacterial adherence. Investigations were continued to determine the effects of culture conditions on the nature and yields of sucrose-metabolizing enzymes from various strains of Strep. mutans. The most pronounced effects to date have been observed with bicarbonate, which has produced differences in distributions and electrophoretic characteristics of the enzymes at concentrations of 1.5 percent compared to concentrations of 0.1 percent or less. A preparatory electrophoretic procedure was developed and used to achieve partial purification of some of the polysaccharide-synthesizing enzymes. Initial experiments are in progress to determine the effects of culture conditions, bacterial factors, and potential enzyme-regulating agents on the adherence of Strep. mutans strains to human tooth slabs.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Cont.)

(Histopathology Division)

The ultimate objective of this work unit is to eliminate oral bone destruction in Navy and Marine Corps personnel. A standardized regimen was developed in FY75 to induce, without mechanical trauma, destructive periodontal bone lesions in a reliable animal model. This model system (*Orzomys palustris*) has been used in FY76 to evaluate the potential usefulness of therapeutic agents in reducing or eliminating periodontal bone destruction. Dexamethazone, a synthetic steroid with potent anti-inflammatory effects and few side effects, was employed prophylactically for a period of 45 days in one group of animals in an attempt to alter the inflammatory response and ultimately, the destructive phases of the disease. Morphometric analysis of treated and untreated animals showed dexamethazone statistically ineffective in reducing the total alveolar bone loss. Whereas total bone loss was less in dexamethazone treated animals, the average bone loss as measured at the mesial plate alone was greater in the treated group. Inflammatory changes were not significantly different in the two groups, nor were the average number of osteoclasts per unit of remaining alveolar bone surface. The results thus indicate that while periodontal bone destruction is believed to be induced by inflammatory changes, the prophylactic use of anti-inflammatory drugs does not help to eliminate oral bone destruction in periodontal diseases. Current tests are being conducted to evaluate the potential usefulness of antibiotics and other plaque reducing drugs.

(Microbiology Division)

A selective medium for the isolation of Streptococcus mutans has been developed. The medium inhibited all other microorganisms in over 90 per cent of the dental plaques sampled. This allows for the isolation of Strep. mutans when present in low levels in a sample.

A semi-selective medium for Actinomyces viscosus and Actinomyces naeslundii has been developed. In preliminary studies the Actinomyces were found in the approximal spaces of naval recruits in the range of 10^4 to 10^7 . The number of Actinomyces isolated appears to be dependent on the amount of dental plaque found. The more plaque present, the greater the number of Actinomyces isolated. With the development of a semiselective Actinomyces medium, naval personnel can be examined as to where these organisms are in the mouth and relate their presence and numbers to oral disease.

Streptococcus mutans when grown in a sucrose containing medium produces extracellular polysaccharides as glucans. These glucans aid in the adherence of the organisms to teeth, as well as offering a protective coating for the organism against the mouth's natural defenses. Mutants of Strep. mutans, when they lose their ability to produce extracellular glucans, become noncarriogenic. An attempt is underway to determine if there is a difference in the amount of glucans produced from the Strep. mutans isolated from

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Cont.)

caries-free and caries-active recruits. Preliminary data indicates that more extracellular polysaccharide is produced from the Strep. mutans isolated from the caries-active recruits.

A cross-sectional epidemiologic study of the site distribution and quantity of Streptococcus mutans in 200 caries-free and 110 caries-active naval recruits was completed. This study demonstrated: (1) the individual sites of a caries-active recruit contain more microorganisms than the comparable sites of the caries-free subject; (2) overall, the caries-active recruit has more positive sites than can be found in the caries-free recruit, and (3) the presence of S. mutans can be detected in the interproximal and buccal-lingual sites of both groups more frequently than in occlusal sites.

The longitudinal epidemiologic aspect of this study has just begun. Some of the subjects who were previously sampled have been located as to their present duty stations so that they may be resampled. However, there is not sufficient data to make any conclusions.

A total of 129 fungal isolates were studied for new sources of dextrans. An active extracellular dextranase was synthesized by a strain of Fusarium moniliforme. This dextranase had a greater relative activity than a commercial dextranase, toward both water soluble and insoluble glucans isolated from Strep. mutans. The purified enzyme was found to have a greater affinity for hydroxyapatite, than a commercial dextranase derived from a species of Penicillium.

A study to determine whether or not a caries-free subject has a more sensitive ability to taste sugar solutions when compared to the caries-active subject has just been completed. Theoretically, the ability to taste minute amounts of sugar and glucose may be correlated with the absence of dental caries. At the present time, the results have not been analyzed. Sixty recruits were included in this study which was completed in conjunction with investigators from the University of Connecticut.

Vaccine Study. Pregnant Macaca fascicularis monkeys were infected with Strep. mutans. Their offsprings were either immunized or sham-immunized with vaccine against Strep. mutans. The immunized group acquired fewer Strep. mutans and had less sites infected than the sham-immunized control group. In a continuation of this study, five young monkeys were intraorally immunized against Strep. mutans and four were sham-immunized. At present, it is still too early to determine the protective effects of the vaccine against caries.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES,
STAFF ARRIVALS, DEPARTURES AND REENLISTMENTS

JANUARY

Dr. I. L. SHKLAIR was nominated for Program Chairman of the Microbiology Section of the American Association for Dental Research.

FEBRUARY

DT1 C. A. DOWNING was advanced to Chief Petty Officer.

Dr. I. L. SHKLAIR was appointed "Special Consultant" to the editor of the Journal for Dental Research for manuscript judging.

Dr. L. G. SIMONSON made a deposition of type culture of Fusarium moniliforme to American Type Culture Collection (ATCC #32426) and Deutsche Sammlungs Von Mikroorganismen (DSM) Gottingen, West Germany.

MARCH

Captain W. R. COTTON was elected President of the Pulp Biology Group of the International Association for Dental Research, and was also elected President of the Pulp Biology Chapter, of the American Association for Dental Research.

was selected for inclusion in "American Men and Women of Science," 13th Edition.

DTCS J. E. SCHEER reported aboard for duty from Naval Medical Research Institute, Bethesda, Maryland.

Dr. I. L. SHKLAIR was elected Program Chairman for the Microbiology Division of the International Association for Dental Research.

APRIL

Captain W. R. COTTON was named as a member of the Journal of Dental Research Advisory Editorial Board for 1976 to 1978.

was included in "Men of Achievement," 4th Edition.

DN S. DAVIS was released from active duty.

DT2 W. V. REESE reported aboard for duty from Naval Regional Medical Center, Corpus Christi, Texas.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES
AND REENLISTMENTS (Continued)

APRIL (Cont.)

CDR J. E. YEAGER was frocked to Captain.

MAY

Captain W. R. COTTON was Reviewing Officer, Recruit Graduation,
Recruit Training Command, Great Lakes.

HM3 D. R. JACKOLA was advanced to HM2.

Dr. B. L. LAMBERTS was elected to the position of Treasurer of the
Chicago Section of the American Association for Dental
Research.

Dr. B. L. LAMBERTS and Dr. L. G. SIMONSON submitted an application
for ONR patent on "The Improvement of Dextranases or Other
Glucanohydrolases for Suitability as Oral Therapeutic Agents
by Molecular Alteration."

DTC H. J. MAYHEW was transferred to the Fleet Reserve.

JUNE

Naval Dental Research Institute Change of Command Ceremony was held.

Captain W. R. COTTON was transferred to Naval Medical Research
Institute, Bethesda, Maryland.

Mrs. J. DAVIS, GS-5, Biological Lab Technician (Micro) departed.

LT J. W. GALICH reported aboard for duty.

SSGT A. J. HORTON, JR., USAF, reported aboard for duty from Incirlik
CDI, Turkey.

Captain H. J. KEENE was transferred to Naval Medical Research and
Development Command, Bethesda, Maryland.

Mr. K. E. KUETER received a Commanding Officer's Certificate for
Outstanding Performance for 1975-1976.

The Thomas S. Meyer Memorial Library was dedicated.

LT R. J. LINDSAY reported aboard for duty from MUST Company,
2nd Marine Division, Camp Lejeune, North Carolina.

Captain M. R. WIRTHLIN assumed the Command of the Naval Dental
Research Institute

Captain J. E. YEAGER was officially promoted to Captain.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES
AND REENLISTMENTS (Continued)

JULY

Mrs. K. BUCK transferred to the Naval Regional Finance Center, Great Lakes.

LCDR D. D. DAVID retired from active duty and was awarded the Navy Commendation Medal.

LCDR R. W. GAUGLER reported aboard for duty from National Naval Dental Center, Bethesda, Maryland.

Dr. E. P. LEONARD was elected to membership in the Midwest Society of Electron Microscopists.

LCDR R. G. WALTER accepted a Regular Navy Commission.

AUGUST

CDR G. E. CLARK reported aboard for duty from Naval Medical Research Institute, Bethesda, Maryland.

DTC C. A. DOWNING was transferred to Headquarters, Support Activity, Taipei.

LCDR R. W. GAUGLER received the Navy Achievement Medal.

CDR E. B. HANCOCK reported aboard for duty from USS Sperry.

Mrs. B. KIRKMAN, GS-4, Clerk/Steno, departed.

SEPTEMBER

Mrs. D. PINNEO, GS-4, Clerk/Steno, arrived.

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